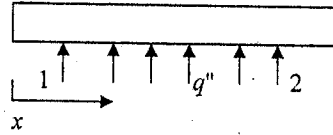
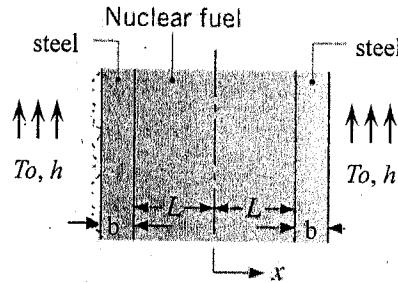


所別：中國文學系碩士班 甲組 科目：中國思想史

1. Consider flow in a circular tube. Within the test section length (between 1 and 2) the tube is heated with a constant heat flux q'' .



- (a) (10%) For the two cases sketch qualitatively the surface temperature $T_s(x)$ and the fluid mean temperature $T_m(x)$ as a function of distance along the test section x . In case A flow is hydrodynamically and thermally fully developed. In case B flow is not developed.
- (b) (10%) Assuming that the surface flux and the inlet mean temperature $T_{m,1}$ are the same for both cases, will the mean temperature $T_{m,2}$ for case A be greater than, equal to, or less than $T_{m,2}$ for case B? Briefly explain why.
2. (20%) A nuclear fuel element of thickness $2L$ is covered by a steel cladding of thickness b . Energy generated within the nuclear fuel at a rate q is removed by a fluid at T_o which adjoins each side surface and is characterized by an equivalent convection coefficient h . The fuel and steel have thermal conductivities of k_f and k_s , respectively. (a) Sketch the temperature distribution $T(x)$ for the system. (b) What are the highest and lowest temperatures in the fuel? (c) What are the corresponding locations?



3. (10%) The property entropy is defined as $dS = \left(\frac{\delta Q}{T} \right)_{\text{int rev}}$. Consider a cycle that is made up of two processes: process 1-2, which is arbitrary (reversible or irreversible), and process 2-1, which is internally reversible. From the Clausius inequality ($\oint \frac{\delta Q}{T} \leq 0$), show that the entropy change of a closed system during an irreversible process is greater than the integral of $\frac{\delta Q}{T}$ evaluated for that process, and

$$\Delta S_{\text{sys}} = S_2 - S_1 = \int \frac{\delta Q}{T} + S_{\text{gen}}, \text{ where } S_{\text{gen}} \text{ represents the entropy generation.}$$

4. (10%) What are the characteristics of all heat engines? Draw the schematic of a steam power plant and explain why it is a heat engine.
5. (10%) When the changes in kinetic and potential energies are negligible, the compressor work for an internally reversible process, the compressor work is given by $w_{\text{rev,in}} = \int v dP$, where P is the pressure and v is the specific volume. Discuss the effect of the specific volume on the work input and the work output. Explain how cooling the gas during a compression process reduces the power consumption.

注意：背面有試題

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6. (10%) In an ideal Brayton cycle, what advantages can be obtained by using intercooling, reheating, or regeneration? Please discuss.
7. (10%) Explain the following terms:
- (a) Dew-point temperature.
 - (b) Joule-Thomson Coefficient.
 - (c) Adiabatic flame temperature.
8. (10%) Answer the following questions.
- (a) How does the presence of moisture in air affect the outcome of a combustion process?
 - (b) How does the presence of N_2 in air affect the outcome of a combustion process?
 - (c) In determining chemical equilibrium, the criterion is usually expressed in terms of the Gibbs function instead of entropy. Why?